SEQUENCE LISTING

<110> Oklahoma Medical Research Foundation
Sauer, Brian Lee
Rufer, Andreas Walter

<120> Method for Selecting Recombinase Variants with Altered Specificity

<130> OMRF 178

<140> 09/544,045
<141> 2000-04-06

<150> 60/127,977
<151> 1999-04-06

<160> 68

<170> PatentIn version 3.1

<210> 1
<211> 343
<212> PRT
<213> Artificial Sequence

<220>
<223> Cre

<400> 1

Met Ser Asn Leu Leu Thr Val His Gln Asn Leu Pro Ala Leu Pro Val
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Asp Ala Thr Ser Asp Glu Val Arg Lys Asn Leu Met Asp Met Phe Arg
20 25 30

Asp Arg Gln Ala Phe Ser Glu His Thr Trp Lys Met Leu Leu Ser Val
35 40 45

Cys Arg Ser Trp Ala Ala Trp Cys Lys Leu Asn Asn Arg Lys Trp Phe
50 55 60

Pro Ala Glu Pro Glu Asp Val Arg Asp Tyr Leu Leu Tyr Leu Gln Ala
65 70 75 80

Arg Gly Leu Ala Val Lys Thr Ile Gln Gln His Leu Gly Gln Leu Asn
85 90 95

Met Leu His Arg Arg Ser Gly Leu Pro Arg Pro Ser Asp Ser Asn Ala
100 105 110

Val Ser Leu Val Met Arg Arg Ile Arg Lys Glu Asn Val Asp Ala Gly
115 120 125

Glu Arg Ala Lys Gln Ala Leu Ala Phe Glu Arg Thr Asp Phe Asp Gln
130 135 140

Val Arg Ser Leu Met Glu Asn Ser Asp Arg Cys Gln Asp Ile Arg Asn
145 150 155 160

Leu Ala Phe Leu Gly Ile Ala Tyr Asn Thr Leu Leu Arg Ile Ala Glu
165 170 175

Ile Ala Arg Ile Arg Val Lys Asp Ile Ser Arg Thr Asp Gly Gly Arg
180 185 190

Met Leu Ile His Ile Gly Arg Thr Lys Thr Leu Val Ser Thr Ala Gly
195 200 205

Val Glu Lys Ala Leu Ser Leu Gly Val Thr Lys Leu Val Glu Arg Trp
210 215 220

Ile Ser Val Ser Gly Val Ala Asp Asp Pro Asn Asn Tyr Leu Phe Cys
225 230 235 240

Arg Val Arg Lys Asn Gly Val Ala Ala Pro Ser Ala Thr Ser Gln Leu
245 250 255

Ser Thr Arg Ala Leu Glu Gly Ile Phe Glu Ala Thr His Arg Leu Ile
260 265 270

Tyr Gly Ala Lys Asp Asp Ser Gly Gln Arg Tyr Leu Ala Trp Ser Gly
275 280 285

His Ser Ala Arg Val Gly Ala Ala Arg Asp Met Ala Arg Ala Gly Val
290 295 300

Ser Ile Pro Glu Ile Met Gln Ala Gly Gly Trp Thr Asn Val Asn Ile
305 310 315 320

Val Met Asn Tyr Ile Arg Asn Leu Asp Ser Glu Thr Gly Ala Met Val
325 330 335

Arg Leu Leu Glu Asp Gly Asp
340

<210> 2
<211> 13
<212> DNA
<213> artificial sequence

<220>
<223> Inverted repeat sequence

<220>
<221> misc_feature
<222> (1)..(3)
<223> N at positions 1-3 can be A, T, G, or C.

<220>
<221> misc_feature
<222> (6)..(7)
<223> N at positions 6 and 7 can be A, T, G, or C.

<400> 2
nnnacnncgt ata

13

<210> 3
<211> 34
<212> DNA
<213> artificial sequence

<220>
<223> variant lox sites

<220>
<221> misc_feature
<222> (1)..(3)
<223> N at postitions 1-3 can be A, G, C, or T

<220>
<221> misc_feature
<222> (6)..(7)
<223> N at positions 6 and 7 can be A, T, G, C,

<220>
<221> misc_feature
<222> (14)..(21)
<223> N at positions 14-21 can A, G, T, or C

<220>
<221> misc_feature
<222> (28)..(29)

<223> N at postions 28 and 29 can be A, T, G, or C

<220>
<221> misc_feature
<222> (32)..(34)
<223> N at postiions 32-34 can be A, T, G, or C

<400> 3
nnnacnncgt atannnnnnn ntatacgnng tnnn 34

<210> 4
<211> 33
<212> DNA
<213> artificial sequence

<220>
<223> variant lox sites

<400> 4
gatacaacgt atataccttt ctatacgttg tat 33

<210> 5
<211> 34
<212> DNA
<213> artificial sequence

<220>
<223> Specific and non-specific sequences for Cre recombinase

<220>
<221> misc_feature
<222> (1)..(3)
<223> N at postions 1-3 can be A, T, G, or C

<220>
<221> misc_feature
<222> (14)..(21)
<223> N at positions 14-21 can be A, T, C, or G

<220>
<221> misc_feature
<222> (32)..(34)
<223> N at positions 32-34 can be A, T, G, or C

<400> 5
nnnacttcgt atannnnnnn ntatacgaag tnnn 34

<210> 6
<211> 8

<212> PRT
<213> artificial sequence

<220>
<223> oligonucleotide

<400> 6

Ala Thr Arg Val Asx Tyr Gly Cys
1 5

<210> 7
<211> 34
<212> DNA
<213> artificial sequence

<220>
<223> primer

<400> 7
ataacttcgt ataatgtatg ctatacgaag ttat 34

<210> 8
<211> 29
<212> DNA
<213> artificial sequence

<220>
<223> primer

<400> 8
aaataatcta gactgagtgt gaaatgtcc 29

<210> 9
<211> 31
<212> DNA
<213> artificial sequence

<220>
<223> primer

<400> 9
atatataagc ttatcattta cgcgttaatg g 31

<210> 10
<211> 33
<212> DNA
<213> artificial sequence

<220>
<223> primer

<400> 10

ataagcggcc gctgagcttg gctgttttgg cgg 33

<210> 11
<211> 36
<212> DNA
<213> artificial sequence

<220>
<223> primer

<400> 11
gccgtctcga gagagtttgt agaaacgcaa aaaggc 36

<210> 12
<211> 30
<212> DNA
<213> artificial sequence

<220>
<223> primer

<400> 12
gtcaagctag ctagcaggtt tcccgactgg 30

<210> 13
<211> 36
<212> DNA
<213> artificial sequence

<220>
<223> primer

<400> 13
acattgcggc cgcagatctc ctctagagtc gacctg 36

<210> 14
<211> 20
<212> DNA
<213> artificial sequence

<220>
<223> primer

<400> 14
tttgggctag cgaattcgag 20

<210> 15
<211> 20
<212> DNA
<213> artificial sequence

<220>

<223> primer

<400> 15
tttgggccag ctaaacatgc 20

<210> 16
<211> 20
<212> DNA
<213> artificial sequence

<220>
<223> primer

<400> 16
cggtgggaga atgttaatcc 20

<210> 17
<211> 18
<212> DNA
<213> artificial sequence

<220>
<223> primer

<400> 17
ggacacagtg cccgtgtc 18

<210> 18
<211> 21
<212> DNA
<213> artificial sequence

<220>
<223> primer

<400> 18
tctgcgttct gatttaatct g 21

<210> 19
<211> 18
<212> DNA
<213> artificial sequence

<220>
<223> primer

<400> 19
ccaggccagg tatctctg 18

<210> 20
<211> 22
<212> DNA

<213> artificial sequence

<220>
<223> primer

<400> 20
gtacgtgaga tatctttaac cc 22

<210> 21
<211> 22
<212> DNA
<213> artificial sequence

<220>
<223> primer

<400> 21
ttgctggata gtttttactg cc 22

<210> 22
<211> 45
<212> DNA
<213> artificial sequence

<220>
<223> primer

<400> 22
gctatcaact cgcgccctgg gagggatttt tgaagcaact catcg 45

<210> 23
<211> 45
<212> DNA
<213> artificial sequence

<220>
<223> primer

<400> 23
gagttgcttc aaaaatccct cccagggcgc gagttgatag ctggc 45

<210> 24
<211> 45
<212> DNA
<213> artificial sequence

<220>
<223> primer

<400> 24
gctatcaact cgcgccctgg cagggatttt tgaagcaact catcg 45

<210> 25
<211> 45
<212> DNA
<213> artificial sequence

<220>
<223> primer

<400> 25
gagttgcttc aaaaatccct gccagggcgc gagttgatag ctggc 45

<210> 26
<211> 45
<212> DNA
<213> artificial sequence

<220>
<223> primer

<220>
<221> misc_feature
<222> (17)..(25)
<223> N at positions 17-25 can be A, T, G, or C

<400> 26
gctatcaact cgcgccnnnn nnnnnatttt tgaagcaact catcg 45

<210> 27
<211> 45
<212> DNA
<213> artificial sequence

<220>
<223> primer

<220>
<221> misc_feature
<222> (17)..(25)
<223> N at positions 17-25 can be A, T, G, or C

<400> 27
gagttgcttc aaaaatnnnn nnnnnggcgc gagttgatag ctggc 45

<210> 28
<211> 1172
<212> DNA
<213> artificial sequence

<220>
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<400> 28

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caatttactg accgtacacc aaaatttgcc tgcattaccg gtcgatgcaa cgagtgatga 120

ggttcgcaag aacctgatgg acatgttcag ggatcgccag gcgttttctg agcatacctg 180

gaaaatgctt ctgtccgttt gccggtcgtg ggcggcatgg tgcaagttga ataaccggaa 240

atggtttccc gcagaacctg aagatgttcg cgattatctt ctatatcttc aggcgcgcgg 300

tctggcagta aaaactatcc agcaacattt gggccagcta aacatgcttc atcgtcggtc 360

cgggctgcca cgaccaagtg acagcaatgc tgtttcactg gttatgcggc ggatccgaaa 420

agaaaacgtt gatgccggtg aacgtgcaaa acaggctcta gcgttcgaac gcactgattt 480

cgaccaggtt cgttcactca tggaaaatag cgatcgctgc caggatatac gtaatctggc 540

atttctgggg attgcttata acaccctgtt acgtatagcc gaaattgcca ggatcagggt 600

taaagatatc tcacgtactg acggtgggag aatgttaatc catattggca gaacgaaaac 660

gctggttagc accgcaggtg tagagaaggc acttagcctg ggggtaacta aactggtcga 720

gcgatggatt tccgtctctg gtgtagctga tgatccgaat aactacctgt tttgccgggt 780

cagaaaaaat ggtgttgccg cgccatctgc caccagccag ctatcaactc gcgccctgga 840

agggattttt gaagcaactc atcgattgat ttacggcgct aaggatgact ctggtcagag 900

atacctggcc tggtctggac acagtgcccg tgtcggagcc gcgcgagata tggcccgcgc 960

tggagtttca ataccggaga tcatgcaagc tggtggctgg accaatgtaa atattgtcat 1020

gaactatatc cgtaacctgg atagtgaaac aggggcaatg gtgcgcctgc tggaagatgg 1080

cgattagcca ttaacgcgta aatgataagc ttggctgttt tggcggatga gagaagattt 1140

tcagcctgat acagattaaa tcagaacgca ga 1172

<210> 29
<211> 1172
<212> DNA
<213> artificial sequence

<220>
<223> mxoxox1

<400> 29
tttgggctag cgaattcgag ctcggtaccc ggggatcctc tagactgagt gtgaaatgtc 60

caatttactg accgtacacc aaaatttgcc tgcattacct gtcgatgcaa cgagtgatga 120

ggttcgcaag aacctgatgg ccatgttcag ggatcgccag gcgttttctg agcatacctg 180

gaaaatgctt ctgtccgttt gccggtcgtg ggcggcatgg tgcaagttga ataaccggaa 240

atggtttccc gcagaacctg aagatgttcg cgattatctt ctatatcttc aggcgcgcgg 300

tctggcagta aaaactatcc agcaacattt gggccagcta aacatgcttc atcgtcggtc 360

cgggctgcca cgaccaagtg acagcaatgc tgtttcactg gttatgcggc ggatccgaaa 420

agaaaacgtt gatgccggtg aacgtgcaaa acaggctcta gcgttcgaac gcactgattt 480

cgaccaggtt cgttcactca tggaaaatag cgatcgctgc caggatatac gtaatctggc 540

atttctgggg attgcttata acaccctgtt acgtatagcc gaaattgcca ggatcagggt 600

taaagatatc tcacgtacta acggtgggag aatgttaatc catattggca gaacgaaaac 660

gctggttagc accgcaggtg tagagaaggc acttagtctg ggggtaacta aactggtcga 720

gcgatggatt tccatctctg gtgtagctga tgatccgaat aactacctgt tttgccgggt 780

cagaaaaaat ggtgttgccg cgccatctgc caccagccag ctatcaactc gcgccctggg 840

agggattttt gaagcaactc atcgattgat ttacggcgct aaggatgact ctggtcagag 900

atacctggcc tggtctggac acagtgcccg tgtcggagcc gcgcgagata tggcccgcgc 960

tggagtttca ataccggaga tcatgcaagc tggtggctgg accaatgtaa atattgtcat 1020

gaactatatc cgtaacctgg atagtgaaac aggggcaatg gtgcgcctgc tggaagatgg 1080

cgattagcca ttaacgcgta aatgataagc ttggctgttt tggcggatga gagaagattt 1140

tcagcctgat acagattaaa tcagaacgca ga 1172

<210> 30
<211> 1172
<212> DNA
<213> artificial sequence

<220>
<223> mxoxox2

<400> 30
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caatttactg accgtacacc aaaatttgcc tgcattacct gtcgatgcaa cgagtgatga 120

ggttcgcaag aacctgatgg acatgttcag ggatcgccag gcgttttctg agcatacctg 180

gaaaatgctt ctgtccgttt gccggtcgtg ggcggcatgg tgcaagttga ataaccggaa 240

atggtttccc gcagaacctg aagatgttcg cgattatctt ctatatcttc aggcgcgcgg 300

tctggcagta aaaactatcc agcaacattt gggccagcta aacatgcttc atcgtcggtc 360

cgggctgcca cgaccaagtg acagcaatgc tgtttcactg gttatgcggc ggatccgaaa 420

agaaaacgtt gatgccggtg aacgtgcaaa acaggctcta gcgttcggac gcactgattt 480

cgaccaggtt cgttcactca tggaaaatag cgatcgctgc caggatatac gtaatctggc 540

atttctgggg attgcttata acaccctgtt acgtatagcc gaaattgcca ggatcagggt 600

taaagatatc tcacgtactg acggtgggag aatgttaatc catattggca gaacgaaaac 660

gctggttagc accgcaggtg tagagaaggc acttagcctg ggggtaacta aactggtcga 720

gcgatggatt tccgtctctg gtgtagctga tgatccgaat aactacctgt tttgccgggt 780

cagaaaaaat ggtgttgccg cgccatctgc caccggccag ctatcaactc gcgccctggg 840

agggattttt gaagcaactc atcgattgat ttacggcgct aaggatgact ctggtcagag 900

atacctggcc tggtccggac acagtgcccg tgtcggagcc gcgcgagata tggcccgcgc 960

tggagtttca ataccggaga tcatgcaagc tggtggctgg tccaatgtaa atattgtcat 1020

gaactatatc cgtaacctgg atagtgaaac aggggcaatg gtgcgcctgc tggaagatgg 1080

cgattagcca ttaacgcgta aatgataagc ttggctgttt tggcggatga gagaagattt 1140

tcagcctgat acagattaaa tcagaacgca ga 1172

<210> 31
<211> 1172
<212> DNA
<213> artificial sequence

<220>
<223> mxoxox3

<400> 31
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caatttactg accgtacacc aaaatttgcc tgcattaccg atcgatgcaa cgagtgatga 120

ggttcgcaag aacctgatgg acatgttcag ggatcgccag gcgttttctg agcatacctg 180

gaaaatgctt ctgtccgttt gccggtcgtg ggcggcatgg tgcaagttga ataaccggaa 240

atggtttccc gcagaacctg aagatgttcg cgattatctt ctatatcttc aggcgcgcgg 300

tctggcagta aaaactatcc agcaacattt gggccagcta aacatgcttc atcgtcggtc 360

cgggctgcca cgaccaagtg acagcaatgc tgtttcactg gttatgcggc ggatccgaaa 420

agaaaacgtt gatgccggtg aacgtgcaaa acaggctcta gcgttcgaac gcactgattt 480

cgaccaggtt cgttcactca tggaaaatag cgatcgctgc caggatatac gtaatctggc 540

atttctgggg attgcttata acaccctgtt acgtatagcc gaaattgcca ggatcagggt 600

taaagatatc tcacgtacta acggtgggag aatgttaatc catattagca gaacgaaaac 660

gctggttagc accgcaggtg tagagaaggc acttagcctg ggggtaacta aactggtcga 720

gcaatggatt tccgtctctg gtgtagctga tgatccgaat aactacctgt tttgccgggt 780

cagaaaaaat ggtgttgccg cgccatctgc caccagccgg ctatcaactc gcgccctggg 840

agggattttt gaagcaactc atcgattgat ttacggcgct aaggatgact ctggtcagag 900

atacctggcc tggtccggac acagtgcccg tgtcggagcc gcgcgagata tggcccgcgc 960

tggagtttca atactggaga tcatgcaagc tggtggctgg accaatgtaa atattgtcat 1020

gaactatatc cgtaacctgg atagtgaaac aggggcaatg gtgcgcctgc tggaagatgg 1080

cgattagcca ttaacgcgta aatgataagc ttggctgttt tggcggatga gagaagattt 1140

tcagcctgat acagattaaa tcagaacgca ga 1172

<210> 32
<211> 1172
<212> DNA
<213> artificial sequence

<220>
<223> mxoxox4

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caatttactg accgtacacc aaaatttgcc tgcattaccg gtcgatgcaa cgagtgatga 120

ggttcgcaag aacctgatgg acatgttcag ggatcgccag gcgttttctg agcatacctg 180

gaaaatgctt ctgtccgttt gccggtcgtg ggcggcatgg tgcaagttga ataaccggaa 240

atggtttccc gcagaacctg aagatgttcg cgattatctt ctatgtcttc aggcgcgcgg 300

tctggcagta aaaactatcc agcaacattt gggccagcta aacatgcttc atcgtcggtc 360

cgggctgcca cgaccaagtg acagcaatgc tgtttcactg gttatgcggc ggatccgaaa 420

agaaaacgtt gatgccggtg aacgtgcaaa acaggctcta gcgttcaaac gcactgattt 480

cgaccaggtt cgttcactca tggaaaatag cgatcgctgc caggatatac gtaatctggc 540

atttctgggg attgcttata acaccctgtt acgtatagcc gaaattgcca ggatcagggt 600

taaagatatc tcacgtactg acggtgggag aatgttaatc catattggca gaacgaaaac 660

gctggttagc accgcaggtg tagagaaggc acttagcctg ggggtaacta aactggtcga 720

gcgatggatt tccgtctctg gtgtagctga tgatccgaat aactacctgt tttgccgggt 780

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tggagtttca ataccggaga tcatgcaagc tggtggctgg accaatgtaa atattgtcat 1020

gaactatatc cgtaacctgg atagtgaaac aggggcaatg gtgcgcctgc tggaagatgg 1080

cgattagcca ttaacgcgta aatgataagc ttggctgttt tggcggatga gagaagattt 1140

tcagcctgat acagattaaa tcagaacgca ga 1172

<210> 33
<211> 1172
<212> DNA
<213> artificial sequence

<220>
<223> mxoxox5

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caatttactg accgtacacc aaaatttgcc tgcattaccg gtcgatgcaa cgagtgatga 120

ggttcgcaag aacctgatgg ccatgttcag ggatcgccag gcgttttctg agcatacctg 180

gaaaatgctt ctgtccgttt gccggtcgtg ggcggcatgg tgcaagttga ataaccggaa 240

atggtttccc gcagaacctg aagatgttcg cgattatctt ctatatcttc aggcgcgcgg 300

tctggcagta aaaactatcc agcaacattt gggccagcta aacatgcttc atcgtcagtc 360

cgggctgcca cgaccaagtg acagcaatgc tgtttcactg gttatgcggc ggatccgaaa 420

agaaaacgtt gatgccggtg aacgtgcaaa acaggctcta gcgttcgaac gcactgattt 480

cgaccaggtt cgttcactca tggaaaatag cgatcgctgc caggatatac gtaatctggc 540

atttctgggg attgcttata acaccctgtt acgtatagcc gaaattgcca ggatcagggt 600

taaagatatc tcacgtactg acggtgggag aatgttaatc catattggca gaacgaaaac 660

gctggttagc accgcaggtg tagagaaggc acttagcctg ggggtaacta aacaggtcga 720

gcgatggatt tccgtctctg gtgtagctga tgatccgaat aactacctgt tttgccgggt 780

cagaaaaaat ggtgttgccg cgccatctgc caccagccag ctatcaactc gcgccctggg 840

agggattttt gaagcaactc atcgattgat ttacggcgct aaggatgact ctggtcagag 900

atacctggcc tggtctggac acagtgcccg tgtcggagcc gcgcgagata tggcccgcgc 960

tggagtttca ataccggaga tcatgcaagc tggtggctgg tccaatgtaa atattgtcat 1020

gaactatatc cgtaacctgg atagtgaaac aggggcaatg gtgcgcctgc tggaagatgg 1080

cgattagcca ttaacgcgta aatgataagc ttggctgttt tggcggatga gagaagattt 1140

tcagcctgat acagattaaa tcagaacgca ga 1172

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<212> DNA
<213> artificial sequence

<220>
<223> mxoxox6

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caatttactg accgtacacc aaaatttgcc tgcattaccg gtcgatgcaa cgagtgatga 120

ggttcgcaag aacctgatgg acatgttcag ggatcgccag gcgttttctg agcatacctg 180

gaaaatgctt ctgtccgttt gccggtcgtg ggcggcatgg tgcaagttga ataaccggaa 240

atggtttccc gcagaacctg aagatgttcg cgattatctt ctatatcttc aggcgcgcgg 300

tctggcagta aaaactatcc agcaacattt gggccagcta aacatgcttc atcgtcggtc 360

cgggctgcca cgaccaagtg acagcaatgc tgtttcactg gttatgcggc ggatccgaaa 420

agaaaacgtt gatgccggtg aacgtgcaaa acaggctcta gcgttcgaac gcactgattt 480

cgaccaggtt cgttcactca tggaaaatag cgatcgctgc caggatatac gtaatctggc 540

atttctgggg attgcttata acaccctgtt acgtatagcc gaaattgcca ggatcagggt 600

taaagatatc tcacgtactg acggtgggag aatgttaatc catattggca gaacgaaaac 660

gctggttagc accgcaggtg tagagaaggc acttagcctg ggggtaacta aactggtcga 720

gcgatggatt tccgtctctg gtgtagctga tgatccgaat aactacctgt tttgccgggt 780

cagaaaaaat ggtgttgccg cgccatctgc caccagccag ctatcaactc gcgccctggg 840

agggattttt gaagcaactc atcgattgat ttacggcgct aaggatgact ctggtcagag 900

ataccaggcc tggtctggac acagtgcccg tgtcggagcc gcgcgagata tggcccgcgc 960

tggagtttca ataccggaga tcatgcaagc tggtggctgg tccaatgtaa atattgtcat 1020

gaactatatc cgtaacctgg atagtgaaac aggggcaatg gtgcgcctgc tggaagatgg 1080

cgattagcca ttaacgcgta aatgataagc ttggctgttt tggcggatga gagaagattt 1140

tcagcctgat acagattaaa tcagaacgca ga 1172

<210> 35

<211> 343
<212> PRT
<213> artificial sequence

<220>
<223> mxoxox1

<400> 35

Met Ser Asn Leu Leu Thr Val His Gln Asn Leu Pro Ala Leu Pro Val
1 5 10 15

Asp Ala Thr Ser Asp Glu Val Arg Lys Asn Leu Met Ala Met Phe Arg
20 25 30

Asp Arg Gln Ala Phe Ser Glu His Thr Trp Lys Met Leu Leu Ser Val
35 40 45

Cys Arg Ser Trp Ala Ala Trp Cys Lys Leu Asn Asn Arg Lys Trp Phe
50 55 60

Pro Ala Glu Pro Glu Asp Val Arg Asp Tyr Leu Leu Tyr Leu Gln Ala
65 70 75 80

Arg Gly Leu Ala Val Lys Thr Ile Gln Gln His Leu Gly Gln Leu Asn
85 90 95

Met Leu His Arg Arg Ser Gly Leu Pro Arg Pro Ser Asp Ser Asn Ala
100 105 110

Val Ser Leu Val Met Arg Arg Ile Arg Lys Glu Asn Val Asp Ala Gly
115 120 125

Glu Arg Ala Lys Gln Ala Leu Ala Phe Glu Arg Thr Asp Phe Asp Gln
130 135 140

Val Arg Ser Leu Met Glu Asn Ser Asp Arg Cys Gln Asp Ile Arg Asn
145 150 155 160

Leu Ala Phe Leu Gly Ile Ala Tyr Asn Thr Leu Leu Arg Ile Ala Glu
165 170 175

Ile Ala Arg Ile Arg Val Lys Asp Ile Ser Arg Thr Asn Gly Gly Arg
180 185 190

Met Leu Ile His Ile Gly Arg Thr Lys Thr Leu Val Ser Thr Ala Gly
195 200 205

Val Glu Lys Ala Leu Ser Leu Gly Val Thr Lys Leu Val Glu Arg Trp
210 215 220

Ile Ser Ile Ser Gly Val Ala Asp Asp Pro Asn Asn Tyr Leu Phe Cys
225 230 235 240

Arg Val Arg Lys Asn Gly Val Ala Ala Pro Ser Ala Thr Ser Gln Leu
245 250 255

Ser Thr Arg Ala Leu Gly Gly Ile Phe Glu Ala Thr His Arg Leu Ile
260 265 270

Tyr Gly Ala Lys Asp Asp Ser Gly Gln Arg Tyr Leu Ala Trp Ser Gly
275 280 285

His Ser Ala Arg Val Gly Ala Ala Arg Asp Met Ala Arg Ala Gly Val
290 295 300

Ser Ile Pro Glu Ile Met Gln Ala Gly Gly Trp Thr Asn Val Asn Ile
305 310 315 320

Val Met Asn Tyr Ile Arg Asn Leu Asp Ser Glu Thr Gly Ala Met Val
325 330 335

Arg Leu Leu Glu Asp Gly Asp
340

<210> 36
<211> 343
<212> PRT
<213> artificial sequence

<220>
<223> mxoxox2

<400> 36

Met Ser Asn Leu Leu Thr Val His Gln Asn Leu Pro Ala Leu Pro Val
1 5 10 15

Asp Ala Thr Ser Asp Glu Val Arg Lys Asn Leu Met Asp Met Phe Arg
20 25 30

Asp Arg Gln Ala Phe Ser Glu His Thr Trp Lys Met Leu Leu Ser Val
35 40 45

Cys Arg Ser Trp Ala Ala Trp Cys Lys Leu Asn Asn Arg Lys Trp Phe
50 55 60

Pro Ala Glu Pro Glu Asp Val Arg Asp Tyr Leu Leu Tyr Leu Gln Ala
65 70 75 80

Arg Gly Leu Ala Val Lys Thr Ile Gln Gln His Leu Gly Gln Leu Asn
85 90 95

Met Leu His Arg Arg Ser Gly Leu Pro Arg Pro Ser Asp Ser Asn Ala
100 105 110

Val Ser Leu Val Met Arg Arg Ile Arg Lys Glu Asn Val Asp Ala Gly
115 120 125

Glu Arg Ala Lys Gln Ala Leu Ala Phe Gly Arg Thr Asp Phe Asp Gln
130 135 140

Val Arg Ser Leu Met Glu Asn Ser Asp Arg Cys Gln Asp Ile Arg Asn
145 150 155 160

Leu Ala Phe Leu Gly Ile Ala Tyr Asn Thr Leu Leu Arg Ile Ala Glu
165 170 175

Ile Ala Arg Ile Arg Val Lys Asp Ile Ser Arg Thr Asp Gly Gly Arg
180 185 190

Met Leu Ile His Ile Gly Arg Thr Lys Thr Leu Val Ser Thr Ala Gly
195 200 205

Val Glu Lys Ala Leu Ser Leu Gly Val Thr Lys Leu Val Glu Arg Trp
210 215 220

Ile Ser Val Ser Gly Val Ala Asp Asp Pro Asn Asn Tyr Leu Phe Cys
225 230 235 240

Arg Val Arg Lys Asn Gly Val Ala Ala Pro Ser Ala Thr Gly Gln Leu
245 250 255

Ser Thr Arg Ala Leu Gly Gly Ile Phe Glu Ala Thr His Arg Leu Ile
260 265 270

Tyr Gly Ala Lys Asp Asp Ser Gly Gln Arg Tyr Leu Ala Trp Ser Gly
275 280 285

His Ser Ala Arg Val Gly Ala Ala Arg Asp Met Ala Arg Ala Gly Val
290 295 300

Ser Ile Pro Glu Ile Met Gln Ala Gly Gly Trp Thr Asn Val Asn Ile
305 310 315 320

Val Met Asn Tyr Ile Arg Asn Leu Asp Ser Glu Thr Gly Ala Met Val
325 330 335

Arg Leu Leu Glu Asp Gly Asp
340

<210> 37
<211> 343
<212> PRT
<213> artificial sequence

<220>
<223> mxoxox3

<400> 37

Met Ser Asn Leu Leu Thr Val His Gln Asn Leu Pro Ala Leu Pro Ile
1 5 10 15

Asp Ala Thr Ser Asp Glu Val Arg Lys Asn Leu Met Asp Met Phe Arg
20 25 30

Asp Arg Gln Ala Phe Ser Glu His Thr Trp Lys Met Leu Leu Ser Val
35 40 45

Cys Arg Ser Trp Ala Ala Trp Cys Lys Leu Asn Asn Arg Lys Trp Phe
50 55 60

Pro Ala Glu Pro Glu Asp Val Arg Asp Tyr Leu Leu Tyr Leu Gln Ala
65 70 75 80

Arg Gly Leu Ala Val Lys Thr Ile Gln Gln His Leu Gly Gln Leu Asn
85 90 95

Met Leu His Arg Arg Ser Gly Leu Pro Arg Pro Ser Asp Ser Asn Ala
100 105 110

Val Ser Leu Val Met Arg Arg Ile Arg Lys Glu Asn Val Asp Ala Gly
115 120 125

Glu Arg Ala Lys Gln Ala Leu Ala Phe Glu Arg Thr Asp Phe Asp Gln
130 135 140

Val Arg Ser Leu Met Glu Asn Ser Asp Arg Cys Gln Asp Ile Arg Asn
145 150 155 160

Leu Ala Phe Leu Gly Ile Ala Tyr Asn Thr Leu Leu Arg Ile Ala Glu
165 170 175

Ile Ala Arg Ile Arg Val Lys Asp Ile Ser Arg Thr Asn Gly Gly Arg
180 185 190

Met Leu Ile His Ile Ser Arg Thr Lys Thr Leu Val Ser Thr Ala Gly
195 200 205

Val Glu Lys Ala Leu Ser Leu Gly Val Thr Lys Leu Val Glu Gln Trp
210 215 220

Ile Ser Val Ser Gly Val Ala Asp Asp Pro Asn Asn Tyr Leu Phe Cys
225 230 235 240

Arg Val Arg Lys Asn Gly Val Ala Ala Pro Ser Ala Thr Ser Arg Leu
245 250 255

Ser Thr Arg Ala Leu Gly Gly Ile Phe Glu Ala Thr His Arg Leu Ile
260 265 270

Tyr Gly Ala Lys Asp Asp Ser Gly Gln Arg Tyr Leu Ala Trp Ser Gly
275 280 285

His Ser Ala Arg Val Gly Ala Ala Arg Asp Met Ala Arg Ala Gly Val
290 295 300

Ser Ile Leu Glu Ile Met Gln Ala Gly Gly Trp Thr Asn Val Asn Ile
305 310 315 320

Val Met Asn Tyr Ile Arg Asn Leu Asp Ser Glu Thr Gly Ala Met Val
325 330 335

Arg Leu Leu Glu Asp Gly Asp
340

<210> 38
<211> 343
<212> PRT
<213> artificial sequence

<220>
<223> mxoxox4

<400> 38

Met Ser Asn Leu Leu Thr Val His Gln Asn Leu Pro Ala Leu Pro Val
1 5 10 15

Asp Ala Thr Ser Asp Glu Val Arg Lys Asn Leu Met Asp Met Phe Arg
20 25 30

Asp Arg Gln Ala Phe Ser Glu His Thr Trp Lys Met Leu Leu Ser Val
35 40 45

Cys Arg Ser Trp Ala Ala Trp Cys Lys Leu Asn Asn Arg Lys Trp Phe
50 55 60

Pro Ala Glu Pro Glu Asp Val Arg Asp Tyr Leu Leu Cys Leu Gln Ala
65 70 75 80

Arg Gly Leu Ala Val Lys Thr Ile Gln Gln His Leu Gly Gln Leu Asn
85 90 95

Met Leu His Arg Arg Ser Gly Leu Pro Arg Pro Ser Asp Ser Asn Ala
100 105 110

Val Ser Leu Val Met Arg Arg Ile Arg Lys Glu Asn Val Asp Ala Gly
115 120 125

Glu Arg Ala Lys Gln Ala Leu Ala Phe Lys Arg Thr Asp Phe Asp Gln
130 135 140

Val Arg Ser Leu Met Glu Asn Ser Asp Arg Cys Gln Asp Ile Arg Asn
145 150 155 160

Leu Ala Phe Leu Gly Ile Ala Tyr Asn Thr Leu Leu Arg Ile Ala Glu
165 170 175

Ile Ala Arg Ile Arg Val Lys Asp Ile Ser Arg Thr Asp Gly Gly Arg
180 185 190

Met Leu Ile His Ile Gly Arg Thr Lys Thr Leu Val Ser Thr Ala Gly
195 200 205

Val Glu Lys Ala Leu Ser Leu Gly Val Thr Lys Leu Val Glu Arg Trp
210 215 220

Ile Ser Val Ser Gly Val Ala Asp Asp Pro Asn Asn Tyr Leu Phe Cys
225 230 235 240

Arg Val Arg Lys Asn Gly Val Ala Ala Pro Ser Ala Thr Ser Gln Leu
245 250 255

Ser Thr Arg Ala Leu Glu Gly Ile Phe Glu Ala Thr His Arg Leu Ile
260 265 270

Tyr Gly Ala Lys Asp Asp Ser Gly Gln Arg Tyr Gln Ala Trp Ser Gly
275 280 285

His Ser Ala Arg Val Gly Ala Ala Arg Asp Met Ala Arg Ala Gly Val
290 295 300

Ser Ile Pro Glu Ile Met Gln Ala Gly Gly Trp Thr Asn Val Asn Ile
305 310 315 320

Val Met Asn Tyr Ile Arg Asn Leu Asp Ser Glu Thr Gly Ala Met Val
325 330 335

Arg Leu Leu Glu Asp Gly Asp
340

<210> 39
<211> 343
<212> PRT
<213> artificial sequence

<220>
<223> mxoxox5

<400> 39

Met Ser Asn Leu Leu Thr Val His Gln Asn Leu Pro Ala Leu Pro Val
1 5 10 15

Asp Ala Thr Ser Asp Glu Val Arg Lys Asn Leu Met Ala Met Phe Arg
20 25 30

Asp Arg Gln Ala Phe Ser Glu His Thr Trp Lys Met Leu Leu Ser Val
35 40 45

Cys Arg Ser Trp Ala Ala Trp Cys Lys Leu Asn Asn Arg Lys Trp Phe
50 55 60

Pro Ala Glu Pro Glu Asp Val Arg Asp Tyr Leu Leu Tyr Leu Gln Ala
65 70 75 80

Arg Gly Leu Ala Val Lys Thr Ile Gln Gln His Leu Gly Gln Leu Asn
85 90 95

Met Leu His Arg Gln Ser Gly Leu Pro Arg Pro Ser Asp Ser Asn Ala
100 105 110

Val Ser Leu Val Met Arg Arg Ile Arg Lys Glu Asn Val Asp Ala Gly
115 120 125

Glu Arg Ala Lys Gln Ala Leu Ala Phe Glu Arg Thr Asp Phe Asp Gln
130 135 140

Val Arg Ser Leu Met Glu Asn Ser Asp Arg Cys Gln Asp Ile Arg Asn
145 150 155 160

Leu Ala Phe Leu Gly Ile Ala Tyr Asn Thr Leu Leu Arg Ile Ala Glu
165 170 175

Ile Ala Arg Ile Arg Val Lys Asp Ile Ser Arg Thr Asp Gly Gly Arg
180 185 190

Met Leu Ile His Ile Gly Arg Thr Lys Thr Leu Val Ser Thr Ala Gly
195 200 205

Val Glu Lys Ala Leu Ser Leu Gly Val Thr Lys Gln Val Glu Arg Trp
210 215 220

Ile Ser Val Ser Gly Val Ala Asp Asp Pro Asn Asn Tyr Leu Phe Cys
225 230 235 240

Arg Val Arg Lys Asn Gly Val Ala Ala Pro Ser Ala Thr Ser Gln Leu
245 250 255

Ser Thr Arg Ala Leu Gly Gly Ile Phe Glu Ala Thr His Arg Leu Ile
260 265 270

Tyr Gly Ala Lys Asp Asp Ser Gly Gln Arg Tyr Leu Ala Trp Ser Gly
275 280 285

His Ser Ala Arg Val Gly Ala Ala Arg Asp Met Ala Arg Ala Gly Val
290 295 300

Ser Ile Pro Glu Ile Met Gln Ala Gly Gly Trp Ser Asn Val Asn Ile
305 310 315 320

Val Met Asn Tyr Ile Arg Asn Leu Asp Ser Glu Thr Gly Ala Met Val
325 330 335

Arg Leu Leu Glu Asp Gly Asp
340

<210> 40
<211> 343
<212> PRT
<213> artificial sequence

<220>
<223> mxoxox6

<400> 40

Met Ser Asn Leu Leu Thr Val His Gln Asn Leu Pro Ala Leu Pro Val
1 5 10 15

Asp Ala Thr Ser Asp Glu Val Arg Lys Asn Leu Met Asp Met Phe Arg
20 25 30

Asp Arg Gln Ala Phe Ser Glu His Thr Trp Lys Met Leu Leu Ser Val
35 40 45

Cys Arg Ser Trp Ala Ala Trp Cys Lys Leu Asn Asn Arg Lys Trp Phe
50 55 60

Pro Ala Glu Pro Glu Asp Val Arg Asp Tyr Leu Leu Tyr Leu Gln Ala
65 70 75 80

Arg Gly Leu Ala Val Lys Thr Ile Gln Gln His Leu Gly Gln Leu Asn
85 90 95

Met Leu His Arg Arg Ser Gly Leu Pro Arg Pro Ser Asp Ser Asn Ala
100 105 110

Val Ser Leu Val Met Arg Arg Ile Arg Lys Glu Asn Val Asp Ala Gly
115 120 125

Glu Arg Ala Lys Gln Ala Leu Ala Phe Glu Arg Thr Asp Phe Asp Gln
130 135 140

Val Arg Ser Leu Met Glu Asn Ser Asp Arg Cys Gln Asp Ile Arg Asn
145 150 155 160

Leu Ala Phe Leu Gly Ile Ala Tyr Asn Thr Leu Leu Arg Ile Ala Glu
165 170 175

Ile Ala Arg Ile Arg Val Lys Asp Ile Ser Arg Thr Asp Gly Gly Arg
180 185 190

Met Leu Ile His Ile Gly Arg Thr Lys Thr Leu Val Ser Thr Ala Gly
195 200 205

Val Glu Lys Ala Leu Ser Leu Gly Val Thr Lys Leu Val Glu Arg Trp
210 215 220

Ile Ser Val Ser Gly Val Ala Asp Asp Pro Asn Asn Tyr Leu Phe Cys
225 230 235 240

Arg Val Arg Lys Asn Gly Val Ala Ala Pro Ser Ala Thr Ser Gln Leu
245 250 255

Ser Thr Arg Ala Leu Gly Gly Ile Phe Glu Ala Thr His Arg Leu Ile
260 265 270

Tyr Gly Ala Lys Asp Asp Ser Gly Gln Arg Tyr Gln Ala Trp Ser Gly
275 280 285

His Ser Ala Arg Val Gly Ala Ala Arg Asp Met Ala Arg Ala Gly Val
290 295 300

Ser Ile Pro Glu Ile Met Gln Ala Gly Gly Trp Ser Asn Val Asn Ile
305 310 315 320

Val Met Asn Tyr Ile Arg Asn Leu Asp Ser Glu Thr Gly Ala Met Val
325 330 335

Arg Leu Leu Glu Asp Gly Asp
340

<210> 41
<211> 13
<212> DNA
<213> artificial sequence

<220>
<223> loxP

<220>
<221> misc_feature
<222> (6)..(7)
<223> nn is either TT, TG, GT, GG, TC, CC, or AA

<400> 41
ataacnncgt ata 13

<210> 42
<211> 13
<212> DNA
<213> artificial sequence

<220>
<223> loxK2

<400> 42
ataacaacgt ata 13

<210> 43
<211> 13
<212> DNA
<213> artificial sequence

<220>
<223> loxK1

<400> 43
ataccttgt ata 13

<210> 44
<211> 34
<212> DNA
<213> artificial sequence

<220>
<223> loxP

<400> 44
ataacttcgt atataccttt ctatagcaag ttat 34

<210> 45
<211> 34
<212> DNA
<213> artificial sequence

<220>
<223> loxK2

<400> 45
ataacaacgt atataccttt ctatagcttg ttat 34

<210> 46
<211> 34
<212> DNA
<213> artificial sequence

<220>
<223> loxK1

<400> 46
ataccttttgt atataccttt ctatagaaag gtat 34

<210> 47
<211> 34
<212> DNA
<213> artificial sequence

<220>
<223> loxK2 'GG'

<400> 47
ataacggcgt atataccttt ctatagcccg ttat 34

<210> 48
<211> 34
<212> DNA
<213> artificial sequence

<220>
<223> loxK2 'CC'

<400> 48
ataaccccgt atataccttt ctatagcggg ttat 34

<210> 49
<211> 34
<212> DNA
<213> artificial sequence

<220>
<223> loxK2 'TC'

<400> 49
ataactccgt atataccttt ctatagcgag ttat 34

<210> 50
<211> 34
<212> DNA
<213> artificial sequence

<220>
<223> loxK2 'GT'

<400> 50
ataacgtcgt atataccttt ctatagcacg ttat 34

<210> 51
<211> 34
<212> DNA
<213> artificial sequence

<220>
<223> loxK2 'TG'

<400> 51
ataactgcgt atataccttt ctatagccag ttat 34

<210> 52
<211> 34
<212> DNA
<213> artificial sequence

<220>
<223> LoxP

<400> 52
ataacttcgt ataatgtatg ctatacgaag ttat 34

<210> 53
<211> 34
<212> DNA
<213> artificial sequence

<220>
<223> LoxK1

<400> 53
gagcctttgt atataccttt ctatacaaag gctt 34

<210> 54
<211> 34
<212> DNA
<213> artificial sequence

<220>
<223> loxK2

<400> 54
gatacaacgt atataccttt ctatacgttg tatt 34

<210> 55
<211> 64
<212> DNA
<213> artificial sequence

<220>
<223> Gene

<400> 55
gctagcgaat tcgagcttcg gtacccgggg atcctctaga gtcgacctgc aggcatgcaa 60

gctt 64

<210> 56
<211> 33
<212> DNA
<213> artificial sequence

<220>
<223> oligonucleotide

<400> 56
agcttggagg ctatcatgtc gaccaagcta gca 33

<210> 57
<211> 33
<212> DNA
<213> artificial sequence

<220>
<223> oligonucleotide

<400> 57
gatctgctag cttggtcgac atgatagcct cca 33

<210> 58
<211> 35
<212> DNA
<213> artificial sequence

<220>
<223> oligonucleotide

<400> 58
gatctgatat ctgcggccgc tgacgtgact cgagt 35

<210> 59
<211> 35
<212> DNA
<213> artificial sequence

<220>
<223> oligonucleotide

<400> 59
ctagactcga gtcacgtcag cggccgcaga tatca 35

<210> 60
<211> 13
<212> DNA
<213> artificial sequence

<220>
<223> oligonucleotide

<400> 60
gaagttccta ttc 13

<210> 61
<211> 8
<212> DNA
<213> artificial sequence

<220>
<223> oligonucleotide

<400> 61
tctagaaa 8

<210> 62
<211> 13
<212> DNA
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<220>
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<400> 62
gtataggaac ttc 13

<210> 63
<211> 27
<212> DNA
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<220>
<223> oligonucleotide

<400> 63
gaagttccta ttccgaagtt cctattc 27

<210> 64
<211> 6
<212> DNA
<213> artificial sequence

<220>
<223> oligonucleotide

<400> 64
tctaga 6

<210> 65
<211> 13
<212> DNA
<213> artificial sequence

<220>
<223> oligonucleotide

<400> 65
gaagttcata ttc 13

<210> 66
<211> 13
<212> DNA
<213> artificial sequence

<220>
<223> oligonucleotide

<400> 66
gtatatgaac ttc 13

<210> 67
<211> 13
<212> DNA
<213> artificial sequence

<220>
<223> oligonucleotide

<400> 67
gaagttacta ttc 13

<210> 68
<211> 13
<212> DNA
<213> artificial sequence

D1

<220>
<223> oligonucleotide

<400> 68
gtatagtaac ttc 13